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Three Scenarios of the Future of Work: Technological Unemployment, Compensation, Hollowing Out

Tres escenarios del futuro del trabajo: el desempleo tecnológico, la compensación, la despoblación

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Abstract This study compares the dominant narratives on the future of work. It shows that a paradigm shift is underway in the context of scenario analysis, as a consequence of the rapid development of robotic and computer technologies. In addition to the two main traditions of thought, which respectively emphasize 'technological unemployment' and 'compensation,' a third vision of the future is emerging that examines trends and scenarios ignored by traditional economic theories. This third narrative emphasizes the phenomenon of 'hollowing out,' which states that automation will not cause the complete disappearance of work, but only that requiring average qualifications. In other words, in the absence of corrective interventions, the society of the future will be characterized by the presence of a minority of privileged citizens, who will be able to fully enjoy the fruits of automation, surrounded by a majority of citizens engaged in precarious and degrading jobs. This study also shows that the third narrative is only relatively new: Socio-technical expectations have come full circle, reviving a prognosis already present in Karl Marx's works.
Keywords: Socio-technical Expectations, Automation, Technological Unemployment, Compensation Theories, Hollowing Out

Resumen: Este estudio compara las narrativas dominantes sobre el futuro del trabajo. Pone de relieve que se está produciendo un cambio de paradigma en el contexto del análisis de escenarios, como consecuencia del rápido desarrollo de las tecnologías relacionadas con la robótica e informática. Además de las dos tradiciones principales de pensamiento, que enfatizan respectivamente el "desempleo tecnológico" y la "compensación", está surgiendo una tercera visión de futuro que examina tendencias y escenarios ignorados por las teorías económicas tradicionales. Esta tercera narrativa enfatiza el fenómeno de "vaciado", que establece que la automatización no causará la desaparición completa del trabajo, tan sólo requerirá de unas cualificaciones medias. En otras palabras, ante la ausencia de intervenciones correctivas, la sociedad del futuro se caracterizará por la presencia de una minoría de ciudadanos privilegiados, quienes podrán disfrutar plenamente de los frutos de la automatización, rodeados por una mayoría de ciudadanos que participan en actividades precarias. y trabajos degradantes. Este estudio también muestra que la tercera narrativa es solo relativamente nueva: las expectativas socio-técnicas han dado un giro completo, reviviendo un pronóstico ya presente en las obras de Karl Marx.

Palabras clave: Expectativas sociotécnicas, Automatización, Desempleo tecnológico, Teorías de compensación, despoblación

Two economic theories, two scenarios

Whenever new machines capable of economizing the use of labor have been introduced into the productive fabric, a significant number of workers have lost their jobs. Some of these workers have remained permanently unemployed, others have fallen into the limbo of precarious work, others have found a lower paying or less rewarding job, and others have been retrained and found a better job. Overall, after each critical phase, the economy has always found its equilibrium, albeit on an altered basis. Nobody disputes the occurance of this process, although the reconstructions and evaluations, or – to use a sociological term – the 'narratives' of the process diverge. Here we will examine narratives of the past, the present, and the future of work, in the perspective of the "sociology of socio-technical expectations" (Brown & Michael, 2003; Borup et al., 2006; Arnaldi, 2010, pp. 53-82).

Although the diagnoses, prognoses, and therapies proposed by scholars in the last two centuries are different, the various theoretical perspectives can be grouped into two main schools of thought. On the one hand are those who emphasize the role of automation and, in particular, its propensity to produce technological unemployment. The basic idea is that technological transformations impact the entire complex of production, distribution, and consumption, with ambivalent results, making the corrective and regulatory intervention of the government necessary. After the famous revolt of the Luddites, which took place at the turn of the 18th and 19th centuries, the role of automation and its undesired effects has been emphasized by economists such as David Ricardo (1821) and John Maynard Keynes (1963, pp. 358-373).

On the other hand are those who minimize or even deny the problem of technological unemployment, by stating that unemployment, when it is not voluntary, is cyclical, frictional, temporary, or due to other causes. Furthermore, even if the phenomenon were really the effect of technological development, new jobs regularly emerge to replace those that have disappeared. Therefore, from the technological transformations of the productive complex one should not expect significant changes in the economic system, nor should one think that the intervention of the government is necessary in order to fix the problems. The mechanisms of the market will compensate for the undesired effects of automation. This school of thought can be traced to economists belonging to several different historical periods, such as Adam Smith (1776) and Knut Wicksell (1977).

The economists of the first type are mostly Marxists and Keynesians, with the exception of Ricardo, who throws the cat among the pigeons when he is still one of the main exponents of classical political economy who, along with the neoclassical (marginalist) school, are usually economists of the second type.

Since the two factions are joined not only by economists, but also by sociologists, political scientists, engineers, futurologists, and politicians, we need to use labels able to transcend the disciplines; we opt for 'emphasizers' and 'minimizers' – terms that flexibly represent the two viewpoints highlighted above.

Economic historians already count three industrial revolutions and are now starting a discussion about the idea that humanity is at the dawn of a fourth (Schwab 2017). The first industrial revolution, begun in England in the 18th century, saw the introduction in the factories of the steam engine and mechanical looms. The second industrial revolution, in some countries also called 'take-off,' occurred between the nineteenth and twentieth century and is characterized by the appearance of the internal combustion engine and electricity. The third, which took place in the second half of the twentieth century, saw the introduction of computers and robots into the factories (Campa, 2017 d, pp. 53-78).

Each of these waves in the real world caused a corresponding 'jolt' in the world of ideas. As one can imagine, in the periods of economic crises the narration of the emphasizers appeared to be more convincing, while in the periods of economic expansion the narration of the minimizers was regularly back in vogue (Woirol, 1996). We can therefore agree that both narratives capture elements of truth and at the same time display some limits. History has shown that the emphasizers have tended to overestimate the disruptive character of technological innovations in relation to the tightness of the system. As a matter of fact, downstream of three industrial revolutions, we are still in a capitalist system and the constant growth of productivity has not led to the complete disappearance of wage labor, nor structural mass unemployment. On the other hand, the minimizers tend to overlook the fact that the irreversible crisis of the system has been avoided not only thanks to the compensation mentioned in their theories, but also thanks to continuous government interventions. The so-called 'compensation theories' have a limited applicability, because in the course of the 20th century laissez-faire capitalism has rarely been seen in action. Nationalizations and socializations have not only characterized the economic policy of non-capitalist regimes (fascist and communist regimes, to make it clear), but also democratic-liberal ones. The economy has been constantly driven by industrial policies, while workers have been supported by social policies, such as the reduction of working time, the right to quit, unemployment benefits, sickness insurance, paid maternity leave, pensions, etc. These policies forced entrepreneurs to hire more workers than they would have in a laissez-faire regime. Furthermore, a large portion of unemployed people were reabsorbed into the

public sector or into private companies that have contracts only with the government.

The combination of false alarms by the emphasizers and the self-reassuring narrative by the minimizers, at the turn of the 21st century, led to the belief that politics should deal with anything but the economy, leaving the task of reallocating the resources to the market mechanisms. There are, however, three new elements that invite us to seriously reconsider the disruptive dimension of technological change: 1) the quality of new technologies; 2) the discovery of the hollowing out phenomenon; 3) the fact that, since the 1980s, the neoliberal paradigm has succeeded in reshaping the productive structure of most countries, putting back on stage a laissez-faire capitalism that previously existed only in economic theory.

The quality of new technologies

In recent years, a growing number of observers have begun to emphasize the impact of new technologies on employment. Everything suggests that we are facing a paradigm shift in the field of socio-technical expectations.

A first warning was sounded in 2011 by Erik Brynjolfsson and Andrew McAfee, both researchers of the Massachusetts Institute of Technology. In the book *Race against the machine*, the two scholars try to shed light on one aspect of the economic crisis that mainstream economists have mostly ignored. By analyzing the exceptional economic growth following the great recession of 2008, the authors realize that the vigorous intervention of the American government has led to immediate improvements in various indicators of economic health. GDP has increased, company profits have increased, and investments have rapidly rebounded upwards, especially in the field of equipment and software. Nevertheless, the employment rate did not recover at a similar rate. This observation prompted Brynjolfsson and McAfee to conclude that a drastic change in the production system is under way. In other words, the financial crisis and other political crises have so far prevented us from seeing that we are in the middle of a technological revolution. New technologies are radically changing the concept of work, the way in which value is created, and above all the way in which the economy distributes the created value.

The call to shift attention to technological innovation did not fall into the void. Two years later, the McKinsey Global Institute (MGI) published a report entitled *Disruptive Technologies: Advances that will transform life, business, and the global economy* (Manyika et al., 2013) that directly addresses policy makers. The authors stress that entrepreneurs and politicians should base their decisions on scenario analyses that consider the future impact of technology on society at large. It is no longer possible to talk seriously about politics, even in the short

term, without discussing the impact of innovations such as mobile connections, the automation of cognitive work, the Internet of things, Cloud technology, advanced robotics, autonomous and semi-autonomous vehicles, new generation genomics, energy storage techniques, 3D printers, innovative materials such as nano-materials and nano-structures, and innovations in gas and oil extraction and renewable energy production.

The MGI invites the economic and political elites to get a clear understanding of how technology is reshaping the global economy and society, as well as how it will change it in the next decade, in order to address the risks and opportunities offered by this development. In particular, world leaders "will need to decide how to invest in new forms of education and infrastructure, and figure out how disruptive economic change will affect comparative advantages" (ibid., p. 1). The McKinsey researchers present a generally optimistic scenario,showing that the technologies in their list "have great potential to improve the lives of billions of people" (ibid., p. 18). They quantify a potential economic impact of new technologies on the order of between 14 and 33 trillion dollars a year, starting in 2025. However, as we have already noted in another article (Campa, 2017 a), the trend is mainly aimed at meeting the expectations of large multinational corporations.

The report admits that this future trend may also have negative side effects for other social classes. The benefits of the technologies may not be equally distributed. Technical progress could help to widen inequalities, because the automation of cognitive work and advanced robotics will lead to the replacement of low-skilled workers with machines and software programs, offering opportunities for gains above all to capitalists and high-skilled workers. This admission does not, however, affect the positive picture of the future elaborated by McKinsey analysts, according to whom unwanted side effects can be removed with the same remedies adopted in the past: an increase in work flexibility and technical-scientific education. In this sense, despite the great emphasis on innovation, the image of the future produced by 2013 McKinsey report is still rather 'conservative.' Firstly, the analysts still trust the classical theory of compensation: any job lost because of machines will reappear in the machine-building sector, or in less automated sectors if the labor market is sufficiently flexible. Secondly, they are convinced that "over the long term and on an economy-wide basis, productivity growth and job creation can continue to grow in tandem, as they generally have historically, if business leaders and policy makers can provide the necessary levels of innovation and education" (ibid., p. 27).

In a nutshell, they do not deny the disruptive nature of new technologies, nor the need for government intervention. In this respect, there is a novelty compared to the neoliberal paradigm. However, they seem to limit public policies to the field of education, to better qualify young people and retrain those who lose

their jobs. According to the report, to avoid the specter of mass unemployment, it will be enough to induce citizens to study more mathematics, science, and engineering, and stay away from the humanities.

However, not everyone shares this optimism. Also in 2013, two researchers from the University of Oxford, Carl Benedikt Frey and Michael Osborne, published a report on the transformations of work that over the next five years, would collect more than a thousand citations in the scientific literature. The report is basically an attempt to quantify the risk of job automation in the United States over the next two decades. The methodology adopted by the authors, then extended to the study of other countries, assigns a probability of automation to each type of job, and distinguished three bands: those with a probability of automation lower than 33% (Low), those with a range of probability between 33 and 66% (Medium) and those with a probability higher than 66% (High) . It claims, for example, that scientists are in the Low band, with a 15% probability of being replaced by a robot, while accountants are in the High band at 95%.

As for the United States, given the employment distribution of that country, it found that 33% of the jobs have a low risk of automation, 10% a medium risk, and as much as 47% have a high risk. If half of the working population will actually remain unemployed, we can expect a considerable backlash on the entire economic and social structure.

After the publishing success of *Race Against the Machine*, Brynjolfsson and McAfee returned to the topic of automation in 2014, with a new book titled *The Second Machine Age.* Here, they introduce a concept – the one indicated by the title itself – that went on to be widely used in specialized literature. Since the narration of the minimizers is based on the idea that machines are complementary and not substitutive of human work, the authors respond to this persistent criticism by underlining that we are now in an unprecedented situation. Contrary to what happened during the 'First Machine Age,' corresponding to the early stages of the industrial revolution, the 'Second Machine Age' involves the automation of many cognitive tasks, not just manual ones. This means that new software programs and pieces of hardware are now able to replace human brains, not simply help fatigued workers. The authors emphasize that the pace of automation now grows due to the combined adoption of many emerging technologies, including: advanced robotics, numerical control machines, management software, (voice, speaker, and pattern) recognition systems, machine translation, self-driving vehicles, and online commerce. Innovation in a field is then applied to other fields, accelerating the entire automation process.

In 2015, Martin Ford published a monograph titled *Rise of the Robots*, which even predicts a jobless future. The book immediately captured the attention of the readers, conquering the summit of the *New York Times Best Seller*, and won prestigious awards such as the *Financial Times and McKinsey Business*

Book of the Year Award. Ford also insists that 20th century technological advances have mostly marginalized untrained workers, while 21st century innovations are increasingly threatening the jobs of skilled workers.

Many jobs have already evaporated, but the new sectors of the economy are not generating enough jobs to reabsorb workers expelled from the productive fabric. For example, companies that operate almost exclusively on the Internet (YouTube, Instagram, Facebook, PayPal, Google, Amazon, etc.) use a minimal portion of workforce, while generating very high revenues. If this trend continues, the companies of the future will not be labor intensive. In addition, the phenomena of offshoring and outsourcing, which derive from globalization and are themselves favored by new technologies, must be taken into account. An array of professional positions (accountants, personnel managers, lawyers, radiologists, software designers, etc.) have already been outsourced from Europe and America. Their tasks have been transferred to lower-paid workers in developing countries, by taking advantage of the fact that they have become simple to perform. With only a couple of weeks of corporate training or tutoring, an apprentice is able to learn a job that previously required a master's degree. Typically, the new employee has to learn how to enter data into a piece of software which will do the rest. Interestingly, Ford is a futurist, not an economist. Neoclassical economists tend to remain loyal to their theory and insist that even today's unemployment is frictional, or due to causes other than technological development (Autor 2015).

The year 2015 marked a milestone also for the *World Economic Forum*. Among the analysts invited to Davos there has always been attention to structural unemployment as a possible risk for the economy. However, in previous reports, the risk of unemployment was related to causes other than automation, such as the inadequate education of the new generations, or the repercussions of the global financial crisis that broke out in 2008. In *The Global Risk Report 2014*, for example, we find a mention of a so-called 'lost generation,' in the following terms: "The generation coming of age in the 2010s faces high unemployment and precarious job situations, hampering their efforts to build a future and raising the risk of social unrest" (WEF, 2014, p. 10). This lost generation will not find work because of inadequate preparation: "In advanced economies, the large number of graduates from expensive and outmoded educational systems – graduating with high debts and mismatched skills – points to a need to adapt and integrate professional and academic education" (ibid.). Problems arising from new technologies were seen as limited to the sphere of cyberattacks. The digital society generates insecurity and mistrust in relation to communication processes and, therefore, policy makers are invited to preserve, protect and govern that common good that is cyberspace.

A year later, in *The Global Risk Report 2015*, comes the first change in tone. Unemployment is no longer referred only to the financial crisis or to the

inadequacy of the educational system, but also to the direct impact of new technologies. Robotization and digitization are not yet seen as primary causes of unemployment, but as contributing factors to keeping it high: "Rising structural unemployment drives both inequality and social pressures. Lower economic growth and technological change are likely to keep unemployment high in the future, also in developing countries" (WEF, 2015, p. 15).

In *The Global Risk Report 2016*, we read that "rapid advances in technologies are coupled with ever-growing cyber fragilities and persistent unemployment and underemployment" (WEF, 2016 a, p. 8). Again, a direct causal connection is not stated, but a strong correlation between the two phenomena is at least highlighted. In the same report, the authors insist on the fact that we have entered the fourth industrial revolution, a concept that is identified with that of 'sweeping digitalization.' Indeed, the document underlines that "implications of sweeping digitization (also termed the 'Fourth Industrial Revolution'), ranging from transformations that are the result of rising cyber connectivity to the potential effects of innovations on socio- economic equality and global security, remain far from fully understood" (WEF, 2017, p. 47). Klaus Schwab, the founder and principal animator of the World Economic Forum, who is an engineer as well as an economist, is the one who promotes the use of this interpretative category. Renewing vocabulary is, of course, a way to highlight that contemporary society is in an unprecedented situation.

In 2016, the Forum also published a report entirely dedicated to the future of work, where the concept of the fourth industrial revolution is expanded. The incipit of the document reads as follows: "Today, we are at the beginning of a Fourth Industrial Revolution. Developments in genetics, artificial intelligence, robotics, nanotechnology, 3D printing and biotechnology, to name just a few, are all building on and amplifying one another. This will lay the foundation for a revolution more comprehensive and all-encompassing than anything we have ever seen" (WEF, 2016 b, p. v).

In *The Global Risk Report 2017* is a small section entitled *The Disruptive Impact of Emerging Technologies*, in which the direct relationship between automation and unemployment is eventually stated. It notes that "one obvious channel through which technological change can lead to wider disruption is the labour market, with incomes pushed down and unemployment pushed up in affected sectors and geographical regions. This in turn can lead to disruptive social instability, in line with the GRPS finding this year that the most important interconnection of global risks is the pairing of unemployment and social instability" (WEF, 2017, p. 46). As one can see, now the negative side effects of digitization and automation have become 'obvious.' New technologies are definitively pushing wages down and increasing unemployment.

Finally, *The Global Risk Report 2018* explicitly envisages a future of technological unemployment: "For the foreseeable future, automation and digitalization can be expected to push down on levels of employment and wages, and contribute to increases in income and wealth at the top of the distribution." Besides, it stresses the social along with the economic dimension of the risk, since "norms relating to work are an important part of the implicit contract that holds societies together" (WEF, 2018, p. 9).

Long-term trends and a third scenario

With regard to long-term trends, a particularly important point was made by the Bank of England's chief economist, Andrew Haldane, at the Trades Union Congress in November 2015. Haldane, who had been included by Time Magazine in its list of the 100 most influential people in the world, presented a rich set of statistics to back up ideas that have previously been elaborated by other researchers (e.g. Davidson, 2013), and also managed to condense into a few pages an overview of industrial capitalism that covers three centuries. The speech deserves to be scrutinized in detail, because it comes from the heart of the City, to say one of the pulsating centers of world capitalism, but it reaches conclusions that seem to support theses traditionally supported by the critics of capitalism.

We have seen that since the beginning of the industrial revolution there have been three disruptive waves of technological innovation, each characterized by a first phase of discomfort for the working class and a second phase of resettlement. When new technologies have invaded farms, factories, and offices, unemployment in effected sectors has grown, but then the workforce has been invariably reabsorbed in other productive sectors. Nonetheless, this is only what is seen on the surface. The trend is not simply cyclical, Haldane concluded. On a deeper level, one can observe two long lasting trends that underlie these transformative phases, one of them positive and the other negative

The good news is that, since the beginning of the industrial revolution to the dawn of the 21st century, the real wages of workers have constantly grown. The bad news is a parallel 'hollowing out' of the middle class – a process which is not only persistent but also increasing. A study by Lawrence Katz and Robert Margo (2013) showed that between 1850 and 1910, the share of skilled workers in the US manufacturing sector grew from about 3% to 12%. In the same period, the share of low skilled jobs also increased, going from 58% to about 65%. In contrast, the percentage of workers with average qualifications decreased from 40% to 23%. This is what we mean by 'hollowing out': the occupation pattern takes a U shape. In simple terms, the production and use of industrial machines have generated job opportunities for managers and engineers on the one hand, and for workers without qualifications on the other hand, while the percentage of craftsmen – to say the middle class – has significantly shrunk.

In subsequent phases, the U-shaped curve that represents the disappearing of the middle class becomes even more pronounced. Haldane notes that "moving into the 20th century, and the third industrial revolution, these emerging patterns in jobs and wages have become clearer. Technology appears to be resulting in faster, wider and deeper degrees of hollowing-out than in the past. Why? Because 20th century machines have substituted not just for manual human tasks, but cognitive ones too" (Haldane 2015, p. 14).

The graphs of almost all the industrialized countries, adds the Chief Economist of the Bank of England, "tell a striking and consistent story of mid-skill jobs being lost, counterbalanced by employment gains at the high-skill and, to lesser extent, low-skill segments of the workforce. The U-shape, or 'hollowing out,' has deepened and widened" (ibid.).

Workers who have average qualifications cannot aspire to better paid jobs, but on the other hand they are over-qualified for the less-skilled tasks, so they fall into the limbo of 'underemployment.' In other words, if it is true that not all jobs have disappeared as a result of automation, it is also true that, in the long run, the bifurcation between the elite and the rest of the population is increasing continuously and inexorably.

Haldane also points out that the model based on waves of temporary unemployment and reabsorption, accompanied by the gradual evaporation of the middle class, a substantial holding of employment and an overall increase in wealth, may not apply to the next wave, that is: the fourth industrial revolution, or second machine age, as one prefers. The English economist says that "this time could be different. There is evidence, across a number of countries, of the labour share having fallen over recent decades. […] A number of explanations have been proposed for these falling labour shares, including the falling relative cost of capital goods and globalisation. A third explanation, related to the first two, is technological change" (ibid., p. 15). The presence of the machine, regardless if complementary to or substitute for human work, or whether suitable for physical work or cognitive tasks, has in general resulted in a weakening of the bargaining power of labor towards capital. In summary, the third phase of the industrial revolution has provoked an intensification of trends already visible in the first two phases and, in particular, of the hollowing out of the middle class and of the decrease of the share of income from work in comparison with the share of income from capital. Pessimism concerning the fourth phase is a consequence of the awareness of this trend.

Meanwhile, the other long-term trend, the good one, namely the growth of real wages, has suddenly stopped. Sally Hills and Ryland Thomas, also economists from the Bank of England, and Nicholas Dimsdale, from Queen's College, Oxford, have analyzed the macroeconomic data of the UK over the past three centuries. From 1750 to today, an average productivity growth of 1.1% per

year has been recorded, together with a real wage growth that follows the same upward trend and is equal to 0.9% per annum. So, in the long term, there was no real conflict between machines and humans. However, at the dawn of the 21st century, this trend has come to a halt. This has been confirmed first by a report drawn up two years after the 2008 crisis and a second update that appeared five years later (Hills et al., 2015).

Several arguments have been proposed to explain this situation. As often happens in the social and economic realm, the causes of a phenomenon could be multiple, concomitant, and non-mutually exclusive, and they could also be different in each country. Much has been written about the effects of the global recession of the two-year period 2008-2009, which naturally remains the first suspect. After the crisis, real wages have not returned to their previous level, even in countries that have started growing again, such as the United States of America and the United Kingdom. As for the countries of the Eurozone, several scholars have pointed the finger at the austerity policies of the European Union (Cruces et al., 2015). However, the stagnation or inadequate growth of nominal wages has also been observed in countries such as Germany, which unlike other European countries benefited greatly from the adoption of the euro, especially with regard to the trade balance and the employment rate. The German case is particularly significant, because – in general – when there are very low levels of unemployment (and in Germany they are at an all-time low since the time of unification) wages tend to grow due to the law of supply and demand. In spite of the fact that there is a demand for skilled work, wages have not grown, however. For this unusual phenomenon, the governor of the Bundesbank, Jens Weidmann, has blamed immigration. Thus, the Marxian concept of a 'reserve army of labour' is implicitly revived. These are Weidmann's words: "Bundesbank research suggests that migration from other EU member states partially accounts for dampened wage pressures in Germany" (Jones, 2018). More generally, the effects of globalization, namely the free movement of people, goods, service, and capitals, are called into question. Wage reduction has often been indicated as the only recipe that can make an economy competitive in a global context where goods are imported from countries where workers perceive low wages and enjoy few protections, or where workers with lower salary demands can be easily 'imported.'

According to Haldane, however, the problem is not generated solely by the financial crisis or the globalization of the markets. He, like the many of the other observers we have mentioned above, includes among the possible causes of the decline in wagesthe quality of 21st century technologies, which make human work uncompetitive. While he tries to maintain an optimistic tone, his forecasts are not reassuring for those who need a job to survive. In the next years, "technology *may* be set to change jobs and wages more fundamentally than in the past. Job displacement and creation *may* come thicker and faster than ever previously.

'Hollowing out' *may* become more pervasive. And gaps between those with and without skills, or with and without jobs, *may* widen as never before" (Haldane, 2015, p. 3).

But there is more. Haldane also takes into consideration the hypothesis of the technological Singularity, that is, an overtaking of human intelligence by artificial intelligence, which would make humans completely obsolete (ibid., p. 19). Ray Kurzweil, a director of engineering at Google, in his futuristic projections, sets for 2029 the time of the overtaking of human brain computation power by machines, and for 2045 the advent of the Singularity, which should also involve [self] awareness by the machines (Kurzweil, 2005). It is clear that if such a scenario were to happen, it would not make much sense to talk about technological unemployment. The behavior of conscious machines would become unpredictable, but one can hardly count on the fact that artificial beings more intelligent than humans would place themselves at our service.

Haldane's conclusion is the ultimate sign that we are facing a paradigm shift in scenario analysis. After saying that, as regards the past, Mill was right and Ricardo wrong, looking at the current situation, he concedes that "maybe Ricardo and the Luddites had a point after all, albeit two hundred years too early" (Haldane, 2015, p. 20). With this admission, the expectations about the future of work has come full circle.

Even if the Bank of England chief economist does not go as far, perhaps we should admit that the most forward thinker on these issues was actually Karl Marx. If not from the point of view of therapy, at least from the point of view of diagnosis and prognosis, his narrative can be seen as precursory to the new trend in socio-technical expectations. Not only did the author of *Capital* stress the centrality, for economic and sociological analysis, of concepts such as automation and technological unemployment (Campa, 2017 b, 2017 c), but he also anticipated the hollowing out phenomenon. In other words, he clearly stated that the machine, managed capitalistically, would lead to the gradual disappearance of the middle class. When Marx and Engels (1948, p. 9) warned that "our epoch, the epoch of the bourgeoisie, possesses, however, this distinct feature: it has simplified class antagonisms," and that "society as a whole is more and more splitting up into two great hostile camps, into two great classes directly facing each other – bourgeoisie and proletariat," were they not saying that the enrichment of the upper class (haute bourgeoisie) and the proletarianization of the middle class (petite bourgeoisie) was taking place? In other words, were they not saying that a remodeling of the distribution of wealth according to the U-shaped curve of hollowing out was under way?

Conclusions

To conclude, we will shift from narrative analysis to social analysis. Assuming that the new trend in socio-technical expectations is closer to 'reality' than the previous two, one may ask why this third scenario is now gaining acceptance among analysts. We sketch a tentative explanation. A narrative may become hegemonic even if it is totally disconnected from reality. However, sometimes, a phenomenon, or a process, becomes so pervasive that no narrative can ignore its social effects. We surmise that the hollowing out phenomenon has become fully visible only now simply because only now do we have before us 'real capitalism' – that is to say: a laissez-faire economy. Capitalism began to show its face in the 19th century, but later, after the emergence of the communist regimes, after the great recession of 1929, and above all with the onset of the Cold War, Western societies turned into welfare state systems. To win the challenge against communism, capitalism decided to show a human face, emancipating the working class to a certain extent and slowing down the erosion of the middle class. After the fall of the Berlin Wall, this necessity disappeared and a process already visible in its embryonic stage in the 19th century, and still present at the underground level in the 20th century, like a karst river, has reemerged at the dawn of the 21st century.

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